

CO₂, CH₄, and N₂O Emissions From Oil Palm Plantation On Deep Peat as Affected by N Fertilization

by

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ABSTRACT

Through drainage and nitrogen (N) fertilization, oil palm plantation on peatlands affect emission of the main greenhouse gases (GHG) – carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). Oil palm plantations on peat can also remove CO₂ from the atmosphere via photosynthesis, but the carbon not stored in the biomass or in the peat is returned back to the atmosphere as CO₂. Anaerobic conditions typical for peat soils are highly favorable for the production of CH₄ and N₂O.

This study investigated the short-term effect of N fertilization on CO₂, CH₄ and N₂O emissions from a deep peat soil (~ 8 m) planted with young oil palms (1 year) at a density of 148 palm ha⁻¹ in Bakrie Sumatera Plantation, Jambi. The measurements were conducted in September - October 2010 in an N fertilizer trial with 3 doses of N fertilizer: 0 g urea palm⁻¹ (N0), 200 g urea palm⁻¹ i.e. 14 kg N ha⁻¹ (N1), and 400 g urea palm⁻¹ i.e. 28 kg N ha⁻¹ (N2). The fluxes of gas from the soil surface were measured by using the closed-chamber method. CO₂ was analyzed using an Infra Red Gas Analyzer (IRGA) while N₂O and CH₄ were analyzed by gas chromatography.

Results show a short-term increase in emissions of CO₂ and CH₄ following urea application. After 10 days the emissions were back to normal. The cumulative difference between N1 and N0 and between N2 and N0 was 0.9 Mg C-CO₂ ha⁻¹ and 1.4 Mg C-CO₂ ha⁻¹ respectively for CO₂ emissions, 0.17 kg C-CH₄ ha⁻¹ and 0.25 kg C-CH₄ ha⁻¹ respectively for CH₄ emissions. The same cumulative differences for N₂O emissions were 2 and 8 kg N-N₂O ha⁻¹, respectively. N₂O, CO₂ and CH₄ were 73, 27 and less than 1%, respectively of net greenhouse forcing due to a single N fertilization event.

Keywords : Greenhouse gas, Tropical peatlands, Climate change, Carbon dioxide- Nitrous oxide- Methane emissions.